US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Multiscenario, Spatially-Detailed Forecasting of Utility Steam Coal Traffic for the Ohio River Navigation System

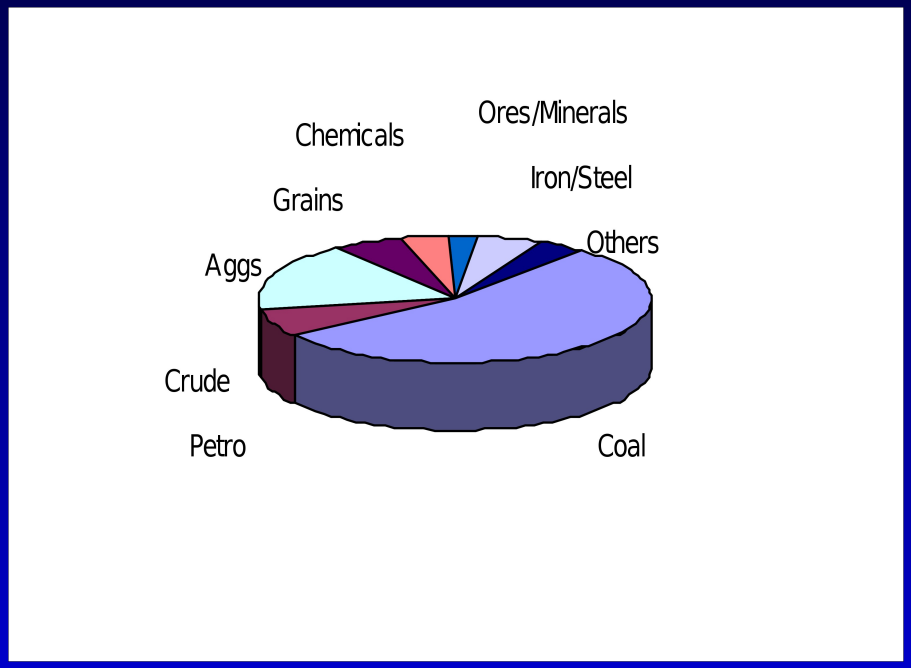
Dale Kelz – CELRH-NC

dale.w.kelz@lrh.usace.army.mil

US Army Corps of Engineers

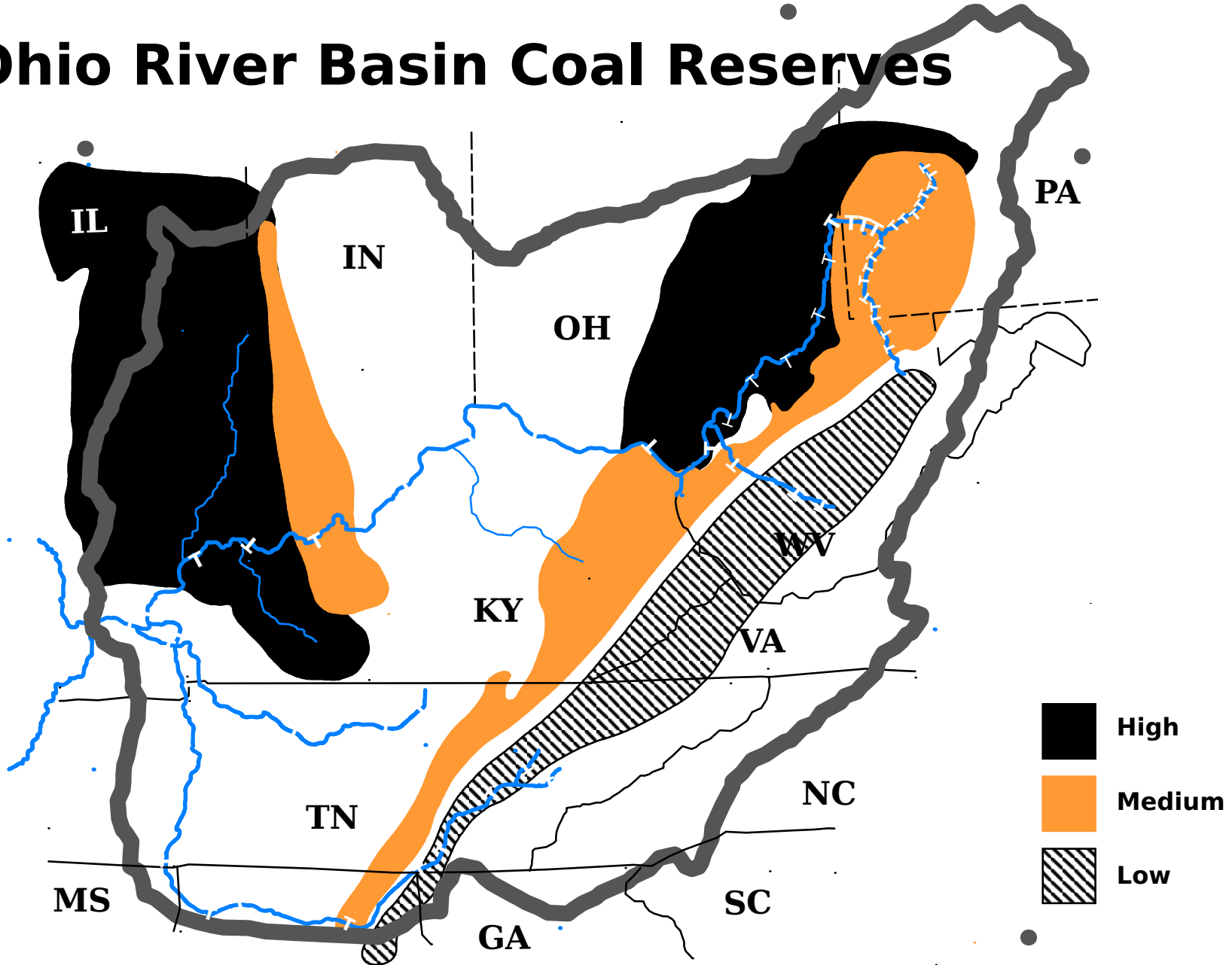
Planning Center of Expertise for Inland Navigation

2005 ORS Traffic - Major Commodities

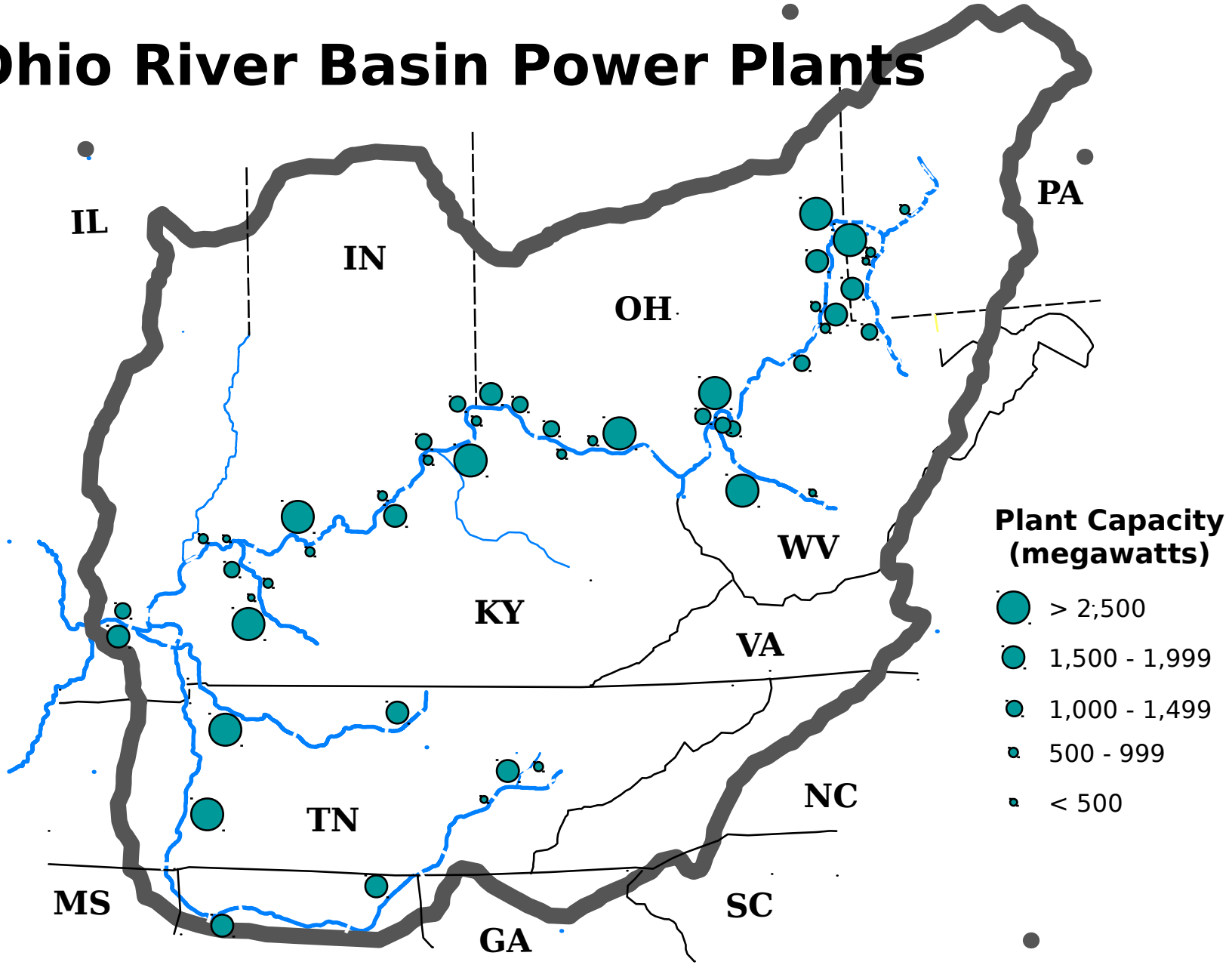


- 280 Mtons in 2005
- Coal accounted for 57%
  - 78% utility steam coal
  - 13% coking/industrial
  - 8% blending (coals not interchangeable)
  - 0.3% export
- Stone, iron & steel, petro accounted for 25%
- Grains, chems, ores & minerals accounted for 12%

Ohio River Basin Coal Reserves



Ohio River Basin Power Plants



US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Environmental Regulations

- 1963 – Clean Air Act
- 1971 – New Source Performance Standards (EPA)
- 1979 – Revised New Source Performance Standards (EPA)
- 1990 -- Clean Air Act Amendments (Phases I and II)
- 1997 – National Ambient Air Quality Standards (EPA)
- 2005 – Clear Air Interstate Rule; Clean Air Mercury Rule; Clean Air Visibility Rule (EPA)

US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Other Issues

- Utility industry deregulation
- Future of nuclear power
- Technological advances
  - integrated gasification combined cycle (IGCC); carbon sequestration
- Coal resource constraints
- Natural gas prices/availability

US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Environmental Proposals

- Multi-Emissions Proposals
  - Clear Skies Amendment
  - Jeffords Amendment
  - Carper Amendment
- Carbon dioxide emissions limitations?
  - Lieberman-Warner Amendment

US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Compliance Strategies

- Scrubbing
- Coal switching
- Coal blending
- Allowance trading
- Fuel switching
- Re-dispatching
- Power purchases
- Combination strategies

US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Forecast Methodology

- Based on Work of Hill and Associates

  -annual forecast of utility steam coal demands

- Based on the Output of 2 Linear Programs

  -National Power Model (NPM)

  -Utility Fuel Economics Model (UFEM)

US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Hill & Associates

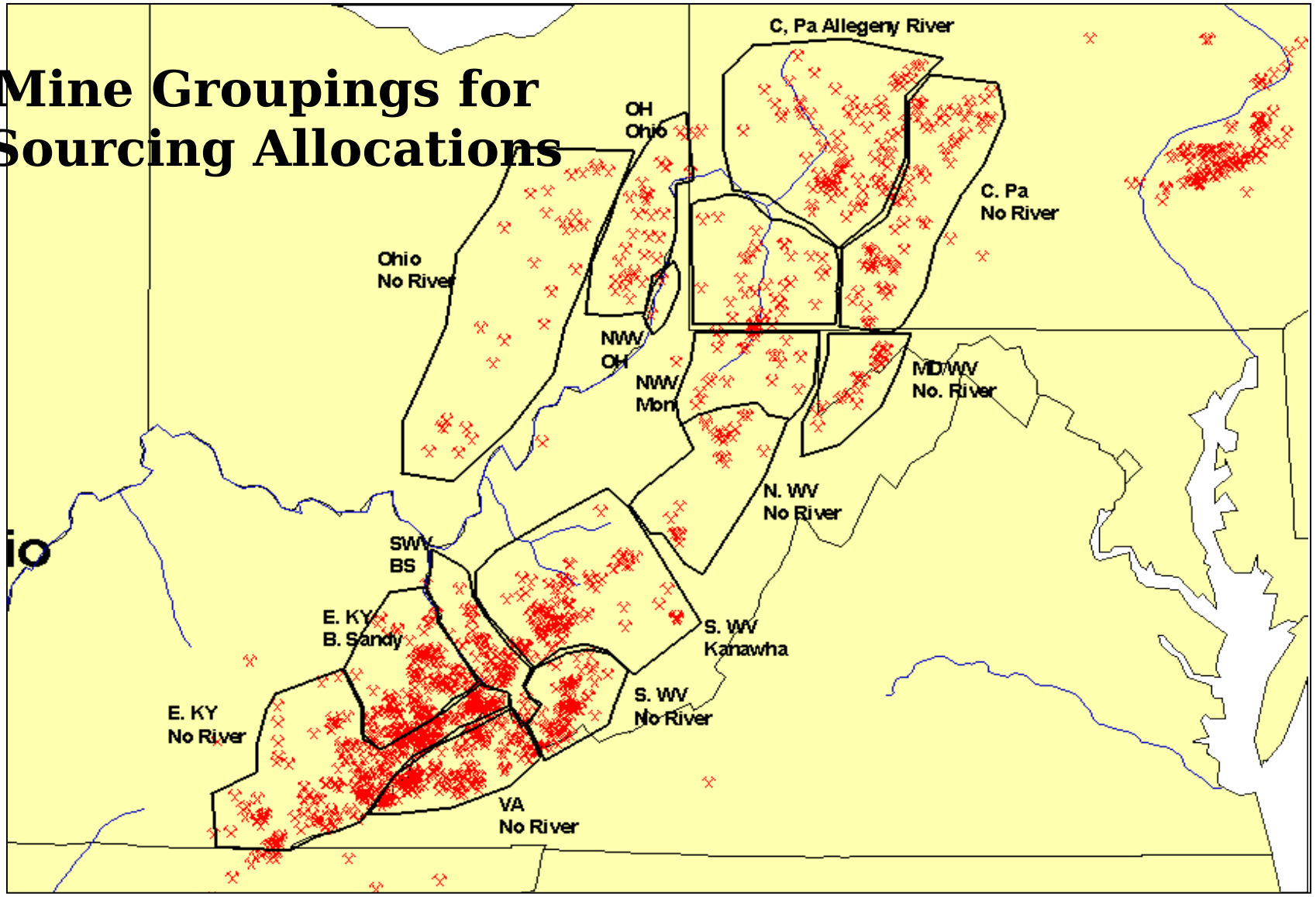
- Heavy focus on electric utilities and coal

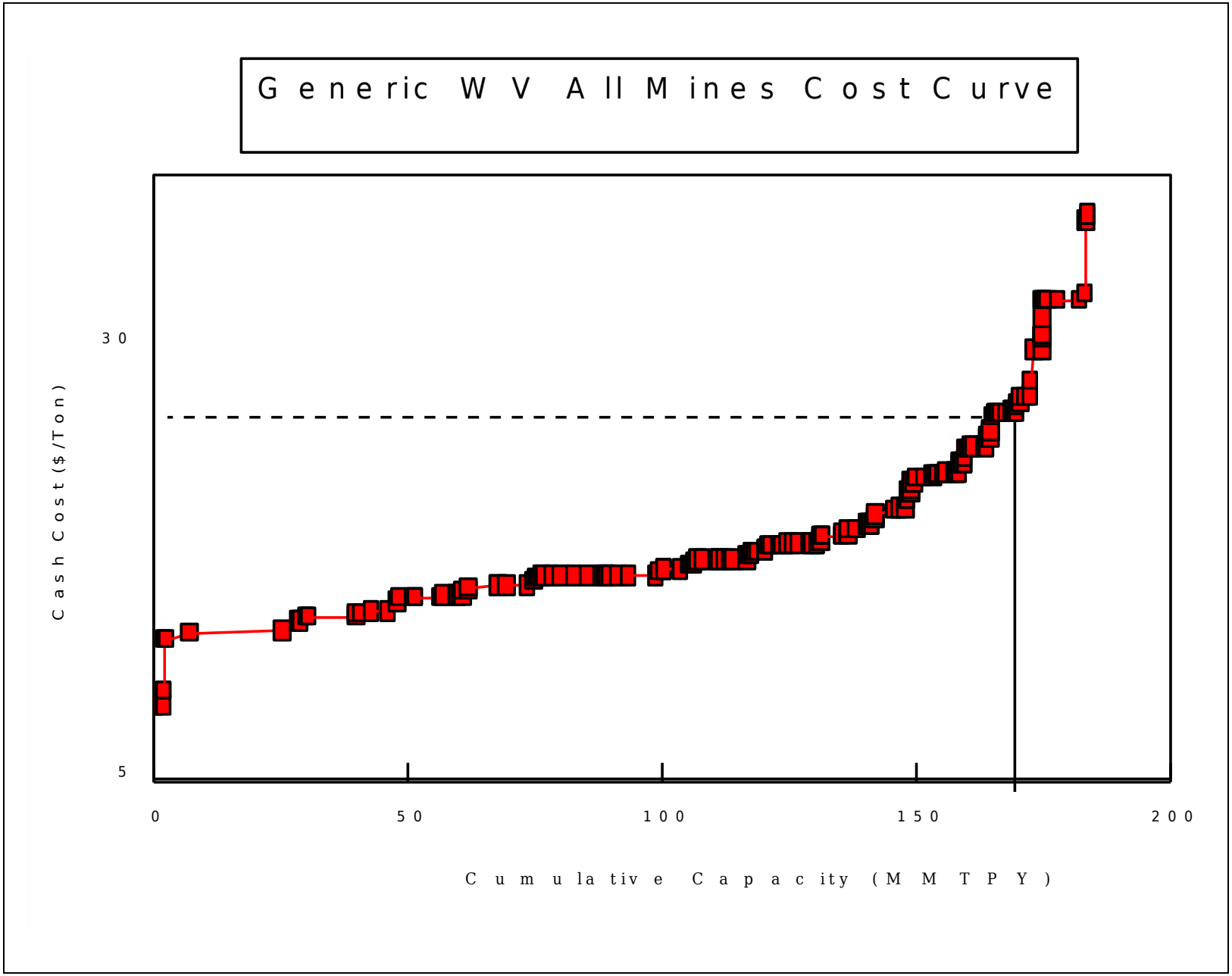
  -clients include DOE, EPA, electric utilities, coal companies
- Fully developed modeling system (NPM & UFEM)
- Always cited by DOE in the Annual Energy Outlook
- Fully completed study of alternative proposals

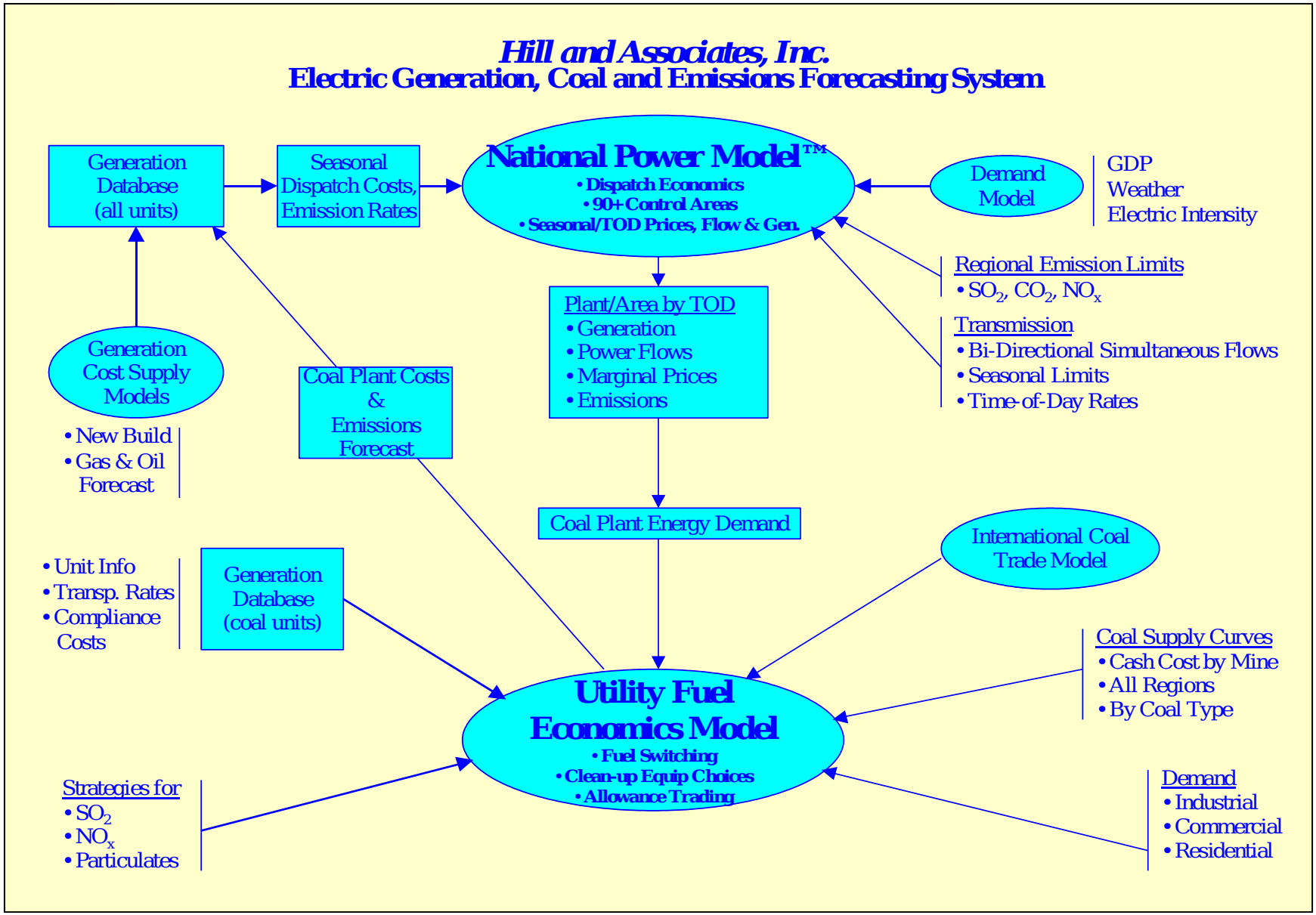
  -plant & unit-specific information

  -coal burn & sourcing for 20-year horizon
- Ability to evaluate a wide variety of scenarios, especially in the area of environmental policy
- Incorporation of international trade

Mine Groupings for Sourcing Allocations




Generic W V All Mines Cost Curve
30
5
Cash Cost($/Ton)
0
50
100
150
200
Cumulative Capacity (MMTPY)


Hill and Associates, Inc.
Electric Generation, Coal and Emissions Forecasting System
Generation Database (all units)
Seasonal Dispatch Costs, Emission Rates
National Power Model™
• Dispatch Economics
• 90+ Control Areas
• Seasonal/TOD Prices, Flow & Gen.
Demand Model
GDP
Weather
Electric Intensity
Regional Emission Limits
• SO2, CO2, NOx
Transmission
• Bi-Directional Simultaneous Flows
• Seasonal Limits
• Time-of-Day Rates
Plant/Area by TOD
• Generation
• Power Flows
• Marginal Prices
• Emissions
Generation Cost Supply Models
• New Build
• Gas & Oil Forecast
Coal Plant Costs & Emissions Forecast
Coal Plant Energy Demand
International Coal Trade Model
• Unit Info
• Transp. Rates
• Compliance Costs
Generation Database (coal units)
Coal Supply Curves
• Cash Cost by Mine
• All Regions
• By Coal Type
Utility Fuel Economics Model
• Fuel Switching
• Clean-up Equip Choices
• Allowance Trading
Strategies for
• SO2
• NOx
• Particulates
Demand
• Industrial
• Commercial
• Residential

US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Forecast Scenarios

- National Ambient Air Quality Standards (NAAQS)
  - -Then-current law
- Clear Skies
  - -Administration's multi-pollutant proposal
- Modified Clear Skies
  - -Clear Skies w/o mercury restrictions

US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Forecast Scenarios

- NAAQS
  - -Then-current environmental regulations
  - -Coal sourcing changes
- Clear Skies
  - -Most restrictive regulations of the 3 scenarios
  - -SO2, NOx, particulates and mercury limits more than halved by 2010; additional restrictions in 2018
  - -Coal sourcing changes

US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Forecast Scenarios

- Modified Clear Skies

  -Same as Clear Skies w/o mercury restrictions

  -SO2, NOx, particulates limits more than

  halved in 2010; additional restrictions

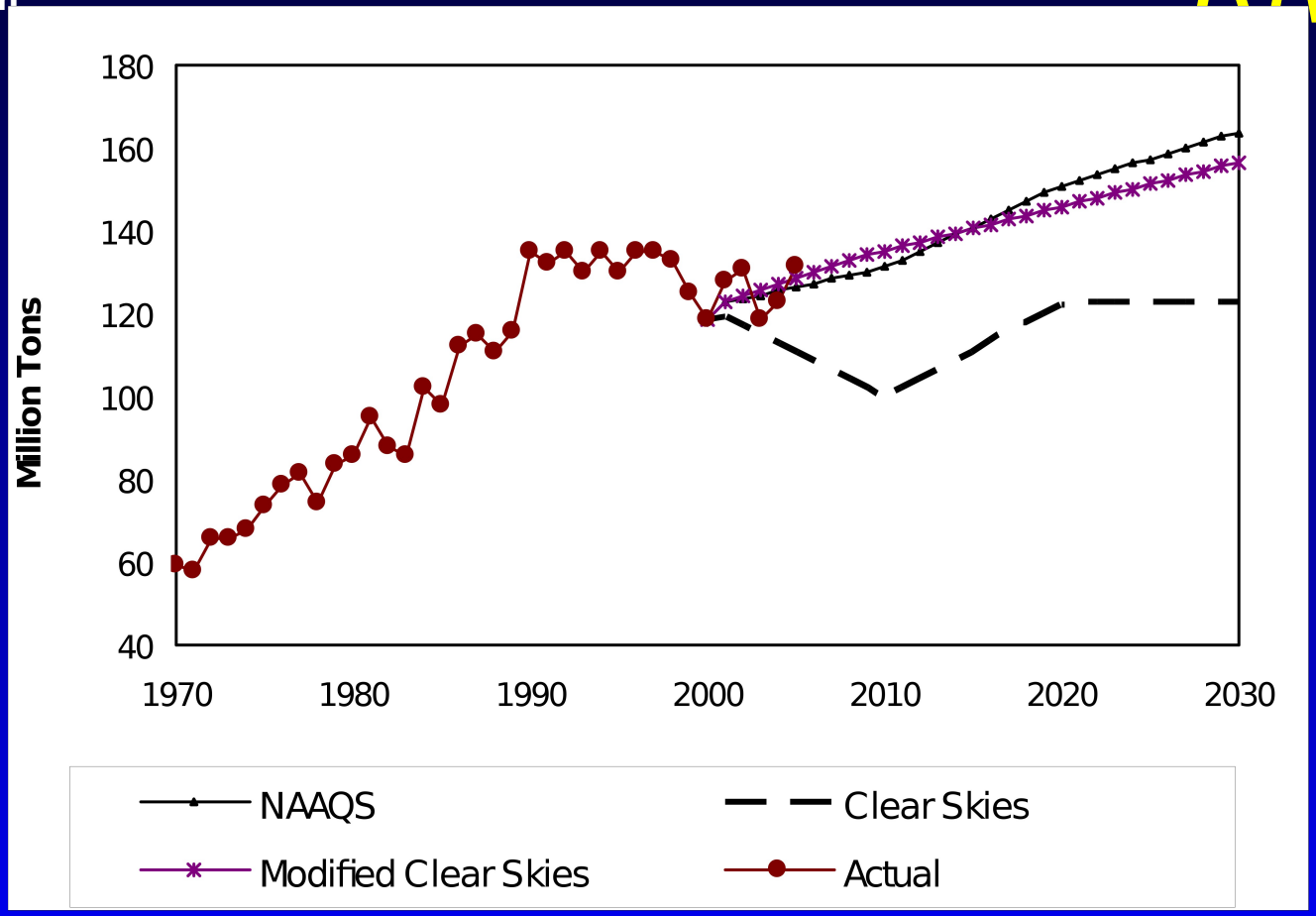
  in 2018

  -Coal sourcing changes

US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Forecast Results – Coal Traffic – Ohio River



US Army Corps of Engineers

Planning Center of Expertise for Inland Navigation

Key Takeaway Points

- The overall modeling approach is well-regarded by the electric utility industry, DOE, EPA and other interests
- The spatial detail provided in this modeling approach is useful for tracking shifts in coal sourcing, volumes and traffic patterns expected to occur with changes in

US Army Corps
of Engineers

Planning Center of Expertise for Inland Navigation

Questions?